GRASSED WATERWAY

(Acre)
Code 412

Natural Resources Conservation Service
Conservation Practice Standard

I. Definition

A natural or constructed channel that is shaped or graded to required dimensions and established with suitable vegetation.

II. Purposes

This practice may be applied as part of a conservation management system to support one or more of the following purposes:

- To convey runoff from terraces, diversions, or other water concentrations without causing erosion or flooding.
- To reduce gully erosion.
- To protect/improve water quality.

III. Conditions Where Practice Applies

This practice is applicable in areas where added water conveyance capacity and vegetative protection are needed to control erosion resulting from concentrated runoff and where such control can be achieved by using this practice alone or combined with other conservation practices.

This practice is not applicable where its construction would destroy important woody wildlife cover or wetlands.

IV. Federal, State, and Local Laws

Users of this standard should be aware of potentially applicable federal, state, and local laws, rules, regulations, or permit requirements governing grassed waterways. This standard does not contain the text of federal, state, or local laws.

V. Criteria

The following criteria apply to all purposes.

A. Drainage Area

Drainage areas must be treated to minimize sediment deposition to the grassed waterway.

B. Capacity

The minimum capacity shall be that required to convey the peak runoff expected from a storm of 10-year frequency, 24-hour duration. When the waterway slope is less than 1 percent, out-of-bank flow may be permitted if such flow will not cause excessive erosion or crop damage.

For channel slopes less than 1 percent, the minimum channel capacity shall be that required to convey the peak runoff from a storm of 2-year frequency, 24-hour duration. When the channel depth exceeds the design depth for these waterways and the flow is confined in the channel (i.e. straightened sections, narrowed floodplains), the velocity from the 10-year frequency, 24-hour duration storm peak discharge shall be less than the allowable velocity in these confined sections.

Waterways which serve as components of barnyard runoff control systems shall have a minimum capacity to convey the peak runoff from a storm of 25-year frequency, 24-hour duration.

Peak discharge for all storms will be determined by the method outlined in NRCS National Engineering Handbook (NEH) Part 650, Engineering Field Handbook (EFH) Chapter 2 or Technical Release 55 (TR-55).

Capacity of waterways shall be based on vegetative retardance A, B, or C. The retardance used shall be in accordance with the EFH Chapter 7 Exhibit 7-2. The retardance used shall consider the types of grasses to be seeded and the type of management anticipated. In urban areas, D retardance may be appropriate for the evaluation of capacity if frequent mowing and maintenance are assured.

C. Velocity

Design velocities shall not exceed the values shown in Table 1. Design velocities shall be

obtained by using the procedures, "n" values, and recommendations in the EFH Chapter 7, or Agricultural Research Service (ARS) Agricultural Handbook 667, Stability Design of Grass-lined Open Channels.

Maximum velocities shall be determined by using a vegetative retardance of D or E.

A minimum velocity of 1.5 fps should be achieved to prevent significant sediment deposition. If this velocity cannot be achieved, the potential deposition problem and associated maintenance requirements shall be addressed in the Operation and Maintenance Plan.

Table 1

Waterway Slope Range (%)	Permissible Velocity [1]	
	Erosion Resistant Soils [2] (ft/sec)	Easily Eroded Soils [3] (ft/sec)
0-5	7	5
5.1-10	6	4
Over 10	5	3

[1] Use velocities exceeding 5 ft/sec only where good cover and proper maintenance can be obtained.

[2] Cohesive (clayey) fine-grain soils and coarse-grain soils with cohesive fines with a plasticity index of 10 to 40 (CL, CH, SC, and GC).

[3] Soils that do not meet the requirements for erosion-resistant soils.

D. Width

The bottom width of trapezoidal waterways shall not exceed 60 feet unless multiple or divided waterways or other means are provided to control meandering of low flows.

E. Side Slopes

Side slopes shall not be steeper than a ratio of two horizontal to one vertical (2:1). They shall be designed to accommodate the equipment anticipated to be used for maintenance and tillage/harvesting equipment that will cross the waterway.

F. Depth

Grassed waterways shall have a minimum depth of 0.6 feet.

The minimum depth of a waterway that receives water from terraces, diversions, or other tributary channels shall be that required to keep the design water surface elevation at, or below the design water surface elevation in the tributary channel, at their junction when both are flowing at design depth.

Freeboard above the designed depth shall be provided when flow must be contained to prevent damage. Freeboard shall be provided above the designed depth when the vegetation has the maximum expected retardance.

G. Drainage

Designs for sites having prolonged flows, a high water table, or seepage problems shall include NRCS Field Office Technical Guide (FOTG), Section IV, Standards 606; Subsurface Drain, and 620, Underground Outlets, stone center sections or other suitable measures to avoid saturated conditions.

The capacity of a stone center section shall be approximately twice the anticipated prolonged flow. The required stone size and gradation will be in accordance with NRCS FOTG Standard 468, Lined Waterway or Outlet. The design velocity for the stone shall be the same velocity used for the waterway.

When the stone center will be placed on erosive soils, a suitable filter or bedding layer or a geotextile must be placed beneath the rock. The filter or bedding layer shall have a minimum thickness of 6 inches where the flow depth will be the greatest. The layer thickness may be reduced near the edges of the stone section.

H. Outlets

All grassed waterways shall have a stable outlet with adequate capacity to prevent ponding or flooding damages. The outlet can be another vegetated channel, an earthen ditch, a grade-stabilization structure, filter strip, or other suitable outlet.

I. Crossings

Crossings shall be in accordance with the criteria contained in NRCS FOTG Standard 578, Stream Crossing.

J. Terrace Outlets

Grassed waterways that serve as terrace outlets shall be established with adequate vegetation prior to the terrace construction.

K. Inlets

All grassed waterways shall have stable inlet areas. The area downstream of bridges, culverts, or other structures shall be stabilized with durable lining materials if vegetation cannot be established.

L. Vegetative Establishment

Grassed waterways shall be vegetated according to NRCS FOTG Standard 342, Critical Area Planting.

Seedbed preparation, time of seeding, mixture rate, stabilizing crop, mulching, or mechanical means of stabilizing, fertilizer, and lime requirements shall be specified for each applicable area.

Establish vegetation as soon as conditions permit. Use mulch anchoring, a nurse crop, straw, or hay bale dikes, filter fences, or runoff diversion to protect the vegetation until it is established.

VI. Operation and Maintenance

An Operation and Maintenance Plan shall be provided to and reviewed with the landowner. The plan shall include the following items and others as appropriate.

A. A maintenance program shall be established to maintain waterway capacity, vegetative cover, and outlet stability. Vegetation damaged by machinery, herbicides, or erosion must be repaired promptly.

B. Seeding shall be protected from concentrated flow and grazing until vegetation is established.

C. Minimize damage to vegetation by excluding livestock whenever possible, especially during wet periods.

D. Inspect grassed waterways regularly, especially following heavy rains. Damaged areas will be filled, compacted, and seeded immediately. Remove sediment deposits to maintain capacity of grassed waterway.

E. Landowners should be advised to avoid areas where forbs have been established when applying herbicides. Avoid using waterways as turn-rows during tillage and cultivation operations. Prescribed burning and mowing may be appropriate to enhance wildlife values, but must be conducted to avoid peak nesting seasons and reduced winter cover.

F. Mow or periodically graze vegetation to maintain design capacity and reduce sediment deposition. To protect nesting wildlife, delay mowing until July 15.

G. Control noxious weeds.

H. Do not use as a field road. Avoid crossing with heavy equipment when wet. Crossing should be done at a right angle to the waterway.

VII. Considerations

Additional recommendations relating to design that may enhance the use of, or avoid problems with, this practice but are not required to ensure its basic conservation functions are as follows.

A. Important wildlife habitat, such as woody cover or wetlands, should be avoided or protected if possible when siting the grassed waterway. If trees and shrubs are incorporated, they should be retained or planted in the periphery of grassed waterways so they do not interfere with hydraulic functions. Mid- or tall bunch grasses and perennial forbs may also be planted along waterway margins to improve wildlife habitat. Waterways with these wildlife features are more beneficial when connecting other habitat types; e.g., riparian areas, wooded tracts and wetlands.

B. Water-tolerant vegetation may be an alternative on some wet sites.

C. Use irrigation in dry regions or supplemental irrigation as necessary to promote germination and vegetation establishment.

D. Provide livestock and vehicular crossings as necessary to prevent damage to the waterway and its vegetation.

E. Establish filter strips on each side of the waterway to improve water quality.

F. Add appropriate vegetation adjacent to the sides of the waterway for wildlife habitat.

G. The modified trapezoidal cross section contained in EFH Chapter 7 should be considered for use on waterways with bottom widths over 20 feet.

VIII. Plans and Specifications

Plans and specifications for grassed waterways shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose(s).

IX. References

USDA, Natural Resources Conservation Service, National Engineering Handbook, Part 650, Engineering Field Handbook.

USDA, Natural Resources Conservation Service, Technical Release 55, Urban Hydrology for Small Watersheds.

USDA, Natural Resources Conservation Service, Wisconsin Field Office Technical Guide, Section IV Conservation Practice Standards and Specifications.

USDA, Agricultural Research Service, Agricultural Handbook 667, Stability of Grass-Lined Open Channels.